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Developing critical thinking in student seafarers: An exploratory study

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Abstract

Short course curricula for seafarers using a traditional, teacher-focused, instructional pedagogy has resulted in students demonstrating surface-level achievement of learning outcomes and limited development of their critical thinking skills. This paper reports on the introduction of a student-centric pedagogy aiming to develop self-directed learning and critical thinking. The elements included introducing authentic and collaborative learning activities, constructively aligned with the content delivery and assessment. The differences between the current 'traditional' approach and a 'student-centric' approach was evaluated. This included a pre- and post-test on student assessment, and a set of semi-structured interviews with the students. A thematic analysis identified three themes including: *authentic learning*, *constructivist learning* and *self-directed learning*. The evaluation demonstrated that a student-centric approach promotes critical thinking and active learning in students, improving learning outcomes.

Introduction

Fedila (2007) proposes that the weakness of traditional teaching methods to seafarer engineers is, that after graduating from their maritime engineering course, they do not have problem solving skills for an onboard working environment. They do not understand how they can apply their knowledge to real life engineering problems: what to do and how to do it. Active seafarers need to have critical thinking skills developed as part of their education. Seafarer's education needs to better enable critical thinking development. In the Australian Maritime College (AMC), students come for seafaring studies from different parts of the world, because there are a variety of courses in Bachelor and Master programs such as Maritime Business and International Logistics study, Marine Engineering and Hydrodynamics, Ocean Seafaring, Coastal Seafaring and a range of short courses. My experience is that students in the Certificate of Proficiency in Survival Craft (CPSC) and similar courses, do not have a habit of seeking an answer independently and do not scan research for knowledge. They go to the teacher directly to get the answer, even if an answer is available in books and the Internet. It has been observed especially international students in my CPSC class and other classes do not adopt critical thinking practices to search for answers by themselves. For example, in a chart work tutorial for cadets I observed, that of the questions students were asking, most of the answers were on the chart. They did not go through a search first to find the answer. Cossette (2013) states that students who use one method of understanding have less likelihood of developing critical thinking skills. An education system that allows students to just memorise information and not use their own thinking in understanding the subjects will not produce all-round students who can work effectively in the seafaring environment.

This research involved students who are seafarers with limited skills in independent analysis and evaluation (n = 24 students). This study explored the effects of adopting a student-focused pedagogy, to see if it would enhance student's ability to learn independently in solving problems and developing critical thinking in the students during a short course.

To evaluate the effectiveness of the changes, quantitative and qualitative methods were applied. Data were collected from participants in two similar short courses. There were ten students in the first short course in which a student-centric teaching method was applied. Fourteen students were in the second short course taught using the traditional teaching method. The first group of ten students were experienced in working on a ship. The second group of fourteen students were studying seafaring at the AMC and this was their first-time on-board a ship.

Background

Students enrolled in seafaring at AMC are from diverse backgrounds. Many methods of instruction are used to develop basic competencies and knowledge in seafaring units. While these do deliver on the competency-based knowledge required of a seafarer, there is a contemporary need to go beyond this to enable critical thinking above surface-level understandings of seafarer competencies surrounding hypothermia, hyperthermia, and lifeboat deployment.

The lecturers in the seafarer short courses currently use what I have termed the 'traditional' teaching method. Within this approach, students typically are subjected to didactic lectures followed by some practical sessions. The lecture is structured so that students are passive observers of the PowerPoint presentation. PowerPoint can be text-heavy with few images or it can be images and text together. The lecturer engages students through questions, showing available resources in the classroom such as real-life material or video relevant to the topic. Students engage with information through listening to the lecture, looking at the PowerPoint slides and taking part in discussion arising from questions asked by any student or from watching videos. During the lecture, there are scaffolded degrees of notetaking observed. Students rely on the lecture presentation as a primary form of instruction, with a limited orientation towards engaging in self-directed problem-solving (e.g. Internet searches, textbooks, or shared sense-making).

This paper identifies the importance of evaluating curriculum within the AMC short courses for the purposes of increasing quality, and eventually being able to assure quality (Carr et al., 2020).

Literature review

This literature review provides an overview of a series of pedagogical methods used within the context of the AMC seafarer short courses, within the overarching context of constructivism. According to Bada and Olusegun (2015), teachers applying constructivist learning pedagogy will encourage students to use large variety of sources which can include primary details, raw data and other interactive materials. The importance of constructivist learning in teaching is it allows students to construct knowledge through activities (Biggs & Tang, 2011). Such activities should be designed to help students achieve the desired learning outcomes. The purpose of instructional design for students should be enabling better processing of information which will be beneficial in their real-life (Halpern, 1998). Biggs and Tang (2011) emphasise structural aspects of design for quality teaching, and taking account of students' approaches to and resulting levels of learning (surface, strategic and deep). Surface learning uses learning activities with low-level cognitive engagement, such as memorising and identifying which produce low level learning outcomes. Strategic learning is intentionally aligned to summative assessment results. While for deep learning students use a full range of activities that involve higher-order cognition such as applying and reflecting, which results in achieving the high-level intended learning outcomes. To encourage deep learning, learning activities should be scheduled over several sessions rather than in a single session. Because learning happens by activating different modes of senses such as hearing, sight, smell, speech, touch and taste, effective learning will happen in students by activating these

different modes.

The review focuses on the following pedagogical approaches: lecture, self-directed learning, authentic learning and constructivist learning. Within the context of this literature review, application and comment is made regarding these within the current course context.

Lectures

Contemporary literature argues for the limited utility of didactic lectures for the twenty-first century student. The teacher should act as a facilitator and the learner should take more responsibility for their own learning by setting goals, identifying learning resources, reflection and evaluation (Collins, 2009). There is no active learning in traditional teaching. Wieman (2007) mentions that a traditional teaching format does not connect much with the students. Students are passive observers listening to the lecturer rather than involved in active learning.

It has been observed that in the current teaching method, the primary activity involved within the class time is selecting information from PowerPoint and making shorthand notes. Most of the students do not take steps to extend their knowledge beyond the presentation. In this method, there is not typically any group discussion, with limited independent searching about the topic information through books and the internet. After the lecture, some students take a copy of the PowerPoint slides. Students rely on the PowerPoint for the topic. This can lead to students interacting less with the content of their textbooks. Most of the students do not develop the habit of referring to their learning guide to read about the topics studied in class. Anderson, Mitchell and Osgood (2006) researched teaching introductory Biochemistry classes using traditional methods. They observed that students do not interact with the learning material. They rely on short term memorisation and are not well engaged with their course. According to Wilson (1996), there is a need to change the lecturing style, which typically presents students with a more passive learning environment. One example of this is through using problem-based learning, which has been demonstrated to be more effective than lectures alone (Tiwari et al., 2006).

Knight and Wood (2017) describe an experiment by comparing traditional teaching with a more interactive class. There was improved learning with the greater clarity of the concepts as compared with a traditional teaching method. In traditional teaching by the researcher, PowerPoint lectures are full of content that discourage student engagement. This passive approach can have a negative effect on facilitating student learning. Bligh (1998) suggested that the main issue in lecturing is that it does not create a deep understanding and truly critical thinking in the students which results in a negative attitude to learning. In the student-centric approached trialed in this research and in response to the literature, presentation PowerPoint in student-centred pedagogy are not full of contents. There is less duration of lecture and only important information is provided through the PowerPoint. Students are given more time in exploring the course contents through textbooks, internet and group discussion.

Self-directed learning

To foster critical thinking in students, the habit of independently solving an issue before going to peers and teachers is a necessary skill; particularly for seafarers who may be subject matter experts on board. Because students who undertake independent work, using a broad range of resources to find solutions demonstrate a greater ability to problem-solve and think critically. Kopzhassarova et al. (2016) describe critical thinking as one person individually solving a complicated problem in the refinement of their critical thinking skills. So, changing teaching methods to support problem-based and self-directed learning can create active learning and critical thinking skills.

In a student-centric teaching approach, there is less lecturing time and more opportunities for student engagement with the content of the topic. Rissanen (2018) reported in his research that engaging students in the class creates better thinking skills, greater motivation, more synthesizes and organising of ideas. Students get a chance to think into their content. This research focused on solving problems through the independent use of multiple resources. These resources are used to inform collective discussion in the class setting. This student-centred teaching method adopts a multi-sensory approach. Students learn through presentations with images, textbooks and authentic websites to answer research questions posed during class sessions, group discussion and finally through feedback by the lecturer. Self-directed learning creates critical thinking as the student faces challenges in solving the problem himself (Saltman, 2012).

Authentic learning

Authentic learning is used in the literature as a method of interpreting one pedagogical approach. Bean (2011) used the phrase 'engaging ideas' synonymously with authentic learning. Oblinger (2007) articulates that authentic learning helps in understanding the issues through different networks and engages learners through active learning rather than passively listening. In response to the literature, the student-centred teaching method facilitates students to use multiple resources such as textbooks, the internet and discussion, increasing their interest in authentic learning. According to Herrington (2006), authentic learning is a more student-centered, real-life focused, and productive learning environment.

In traditional teaching by the researcher, there is no authentic learning in the class. Students have the lecture presentation that includes only unimodal stimuli, e.g. visual (Vazquez & Chiang, 2014), and note-taking, recognising that many students do not take notes. In the student-centric pedagogy, the lecturer delivers the PowerPoint presentation which has plenty of images rather than relying on too much text. The lecturer provides basic information about the topic. After presentation, the lecturer comes up with a questionnaire about the topic. Then students do a planned

activity to find out information about the topic themselves. Students work independently searching for answers from the learning guide and writing down their answers. Students are better engaged with the course contents through a philosophy of teacher leadership to support student digital efficacy (Crawford & Butler-Henderson, 2020). Dayan (2013) provides further evidence of authentic learning and suggests that students should be provided with the opportunity for challenging exploration. This process will help students to dig deeper in the course content which will result in a high standard of authentic learning.

To create critical thinking in the students, it is important to design lessons by embedding authentic learning opportunities into the curricula. Learning activities that can foster the development of thinking skills in the students are critical. Bean (2011) says that student performance improves through writing and critical thinking activities. Students are well-prepared for discussion because the educator uses balanced processing for students through considering all the relevant information and make a decision on that information (Crawford et al., 2020). Writing tasks need to be linked with critical thinking in the students.

Constructivist learning

Constructivist learning creates habits of searching for answers and is drawn on within the context of improving the learning within the seafarer cohort. Bada and Olusegun (2015) addresses the benefits of constructivist learning that it is "mental construction" in which students learn new knowledge through their mental process by keeping in mind previous learning (p.66). Within seafarer traditional education, students see most of the information on PowerPoint slides during presentations. Students do not get a chance to analyze, explore, and search. Liu and Chen (2010, p. 65) define constructivism as a "theory about how we learn and the thinking process, rather than about how a student can memorize and recite a quantity of information". Students should be encouraged to analyse, explore, and search for the problem. In response to the literature, a student-centered approach to teaching, foregrounds student learning by facilitating that learning by students searching the internet and the textbooks for answers. Students are a more active learner and responsible for their learning. Neo (2003) notes that constructivist learning is more student-centered. When students are encouraged to take responsibility for their learning, it results in building their knowledge. To promote students' thinking and understanding process, constructivist learning plays an important role. This is because the focus is on the students actively working through a problem, not on the teacher as in traditional teaching. So, it tries to persuade the students to involve actively in learning process By adopting constructivist learning methods, education will work better for students in thinking and understanding as compared to on rote memorising (Bada and Olusegun, 2015). In the literature, constructivist learning is also referred to similarly as collaborative learning. In traditional teaching by the researcher, the focus is on didactic learning rather than collaboration through discussion. Only during the lecture, the lecturer engages students in asking questions. But there is often limited sharing of thoughts and group conversation. Webb (2010) confirms the importance of group conversation for students to develop their thinking skills. Students clarify their work, reflect, and can often self-identify their faults, which helps them in organising their knowledge and understanding. In the student-centric teaching approach, students engaged in discussion after finding the answers through their research to share and consolidate their thinking.

Knight and Wood (2017) demonstrated the importance of collaborative learning demonstrating shifts in collaborative learning markedly increased learning outcomes for students. Group discussion plays an important part for students involved in solving issues on a topic, and in enabling students to feel they belong in the class (Hawkins et al., 2019). Neo (2003) emphasises collaborative learning that encourages students to present their point and listen to other views. It encourages student social engagement and facilitates meaningful learning. Discussion also plays an important role in critical thinking and in the interaction of students more deeply with material.

It is expected that the student-centred teaching method will encourage students to take responsibility, improve decision-making, and have better engagement with the lecturer and fellow students. Students will be encouraged to investigate, finding meaningful information considering multiple points of views and reflect on their work. The effectiveness of a student-centred teaching method can be measured by students' grades and feedback at the end of a course. This approach also has the propensity to promote a higher level of thinking, following Biggs and Tang's (2011) argument that learning strategies activities should involve analysing and reflecting to promote higher level thinking and deep learning.

Method

This section reports on a mixed-methods approach similar to the mixed-methods for research on an art-gallery-based intervention for people with dementia and their carers (Camic, Tischler & Pearman 2014). It is an investigation of the efficacy of the student-centred teaching method against the traditional (teacher-centred) approach, as an opportunity to assess quality improvement (Carr et al., 2020). The research was approved by the Tasmanian Social Sciences Human Research Ethics Committee (reference number H0018188).

Student-centric versus traditional teaching methods

To test different approaches to supporting learning, a student-centred teaching pedagogy was adopted. The following section describes the two types of teaching methods (see Table 1). The two core lecture components of the short course are described for contextual awareness of the reader.

Table 1: Comparing student-centric teaching approach and traditional teaching method

Learning Resources	Student-centric Teaching Method	Traditional Teaching Method
PowerPoint	Include visual stimuli	Few visuals
	Multimodal	Unimodal
Textbook	Provided to search answer	Not using textbook
Website	Student decision on which resources to use	Not using internet
Group Collaboration	Opportunity for students to collaborate as a learning activity	No group work, only engaging students through questions in class by lecturer
Feedback	Formative feedback provided on the topic's questions in the end	No provision of feedback except answering any questions from students in the class

Applying a student-centric and traditional teaching approach, the research was conducted on students enrolled in a five-day short course, Certificate of Proficiency in Survival Craft (CPSC). The students were informed about the research at the beginning of the course in accordance with the ethics requirements. The student-centric teaching approach was only used in two of the lectures in the first five day course, while the next CPSC student group was taught using the prior (traditional) teaching method.

Lecture on lifeboat

On the first day before taking a pre-test, the students were shown a video of the launching and recovery of the lifeboat. Then the students visited the stowed lifeboat to get an understanding of the lifeboat's features. No explanation of the launching procedure was provided. A pre-test was undertaken after the students had read the consent form and information sheet. After the pre-test, students took part in the classroom activity. During this activity time, the lifeboat's picture in the stowed position was incorporated into the lectures. Questionnaires were then provided, and the students were directed to find the answers from the coursebook first, then using the internet. Students were allocated to groups for discussion of the questionnaires. After the discussion, the lecturer went through the questionnaires. After this teaching activity, the students were again asked to sign the consent form. All students then completed the post-test. This is compared to the second type of learning with traditional teaching approach of next CPSC group. The procedure before taking the pre-test which includes the video of lifeboat launching, recovery and understanding of lifeboat features was similar. Then students had a practical demonstration of lifeboat launch and recovery. The lecturer tried to keep to similar teaching timings as used for the student-centred teaching method.

Lecture on hypothermia and hyperthermia

On the second day of the CPSC course, there was a lecture and video on hypothermia and a lecture only on hyperthermia. Students completed a pre-test on hypothermia and hyperthermia questionnaires for 40 minutes. The questions related to hypothermia and hyperthermia in this pre-test.

Next the lecturer delivered the hypothermia presentation, using the student-centred teaching method. The PowerPoint included mostly images rather than relying on too much text. The lecturer provided basic information about the topic and then the students undertook a planned activity to find the information from their textbook and the internet about the topic themselves, completing questionnaires on hypothermia. Also, websites were provided to search for the answers. After this, the students had a group discussion and finally, the lecturer provided feedback on the questionnaires. Then students were shown a video of hypothermia. Another lecture on hyperthermia and an activity was conducted in a similar way to that for the hypothermia class. Then a post-test was conducted lasting 40 minutes.

The next CPSC group was taught using a traditional teaching method. The lecturer delivered curriculum content on hypothermia and hyperthermia using a traditional PowerPoint presentation. This approach consisted of a presentation without any written activity, group discussion or feedback session as for the student-centred teaching method. During the presentation, there was more text and fewer pictures on the PowerPoint slides. Also, there was a 20 minutes video on hypothermia. The lecturer kept the teaching delivery timing similar to the student-centred teaching method. The differences between the two methods are represented in Table 2.

Table 2. Curriculum and teaching method

CPSC Curriculum	Student-centred method	Traditional Method
Lifeboat	CPSC group 1 - range of activities	CPSC group 2-Practical demonstration only as traditional way
Hypothermia	CPSC group 1 - range of activities	CPSC group 2-lecture and video
Hyperthermia	CPSC group 1 - range of activities	CPSC group 2- lecture only

Quantitative method

The outcomes of the traditional teaching method are compared with the student-centred teaching method. This research spanned two short courses (Total n = 24 students). The first short course (n = 10 students) involved implementing the student-centric teaching approach. In this group, all students had some experience on board ship. Some were completing a deck officer course, and the remaining were completing an engineer officer course. As a working experience on the ship, some had almost one-year experience and some had more than one year. All participants were male, and their age ranged from 22 to 35 ($\bar{x}$ = 28.00, SD = 3.83) (see Table 3).

The second short course (n = 14 students) utilised the traditional teaching method. The second group were experiencing their first time at sea and had only basic knowledge of the shipping industry. Students were doing a Training Integrated Rating course (TIR). 21 percent were female and 79 percent male; their ages ranged from 21 to 51 ($\bar{x}$ = 36.64, SD = 8.66), see Table 4. To ensure ethical compliance, students who received the traditional instruction method, also received the new method after data collection. To collect data, quantitative and qualitative methods were

used (Bryman & Burgess, 2002; Crawford & Kelder, 2019). Pre- and post-tests were taken for both groups.

Qualitative method

Interviews

On the last three days of the first CPSC course, four semi-structured interviews were conducted. The consent form and information sheets were provided before conducting the interviews. The lecturer used a semi-structured interview protocol to guide questions during the interviews. These questions were prepared to keep in mind research aim and teaching practices (student-centred and traditional teaching methods) used in the class. Each interview lasted around twenty-five minutes. The interviews were transcribed verbatim and pseudonyms used for the interviewees (Miles et al., 2014).

Administration:

Before undertaking the interviews, the information sheet and consent form were provided to each interviewee. The following is list of prompting questions:

1. How did you find student-centred teaching method?
2. Did you find it useful in finding the answer by yourself through a book, internet and discussion?
3. Did you find looking answer through the book, internet and discussion create critical thinking in students? Can you explain a bit more, how?
4. Will the students learn more by this teaching method?
5. Do you think by this student-centred teaching method, students will remember their subject for a long time?
6. If in most lectures, lecturers use student-centred teaching method, will it create critical thinking in students and improve their learning.
7. Do you think traditional teaching, or this new method is better in creating critical thinking? Why?
8. Does traditional teaching create critical thinking in students? How?

Inductive thematic analysis

According to Braun and Clarke (2006), transcription of all interviews is important to conduct thematic analysis of the semi-structured interviews. Thorough understanding was developed during data transcription through listening to the audio recording of all interviews. To develop the themes, five phases of inductive thematic analysis were done, in line with the technique outlined by Braun and Clarke (2006).

Phase 1: *Familiarise yourself with the data*

Before starting the coding, immersive reading for all transcriptions was done to ensure familiarisation with the data.

Phase 2: *Generating codes*

Coding was done manually by identifying interesting aspects of data which can build themes later. Highlighter pens of different colors were used for visual identification of similar quotes. For example, three different quotes were identified from a question of one interviewee (learning by yourself, book and internet and discussion). These aligned to the research aim (build critical thinking in the students through providing different resources).

Phase 3: *Searching for themes*

A long list of references/quotes was highlighted on each interview transcript. Quotes whose concepts were embedded, were identified and named into subthemes. A total of nine subthemes were considered to identify a theme. These subthemes are discussed in more detail to tell the story. Pseudonyms are used for the interviewees rather than actual names.

Phase 4: *Reviewing themes*

After reviewing all sub-themes, three unique broad themes are found which are authentic learning, constructivist learning and self-directed learning.

Phase 5: *Defining and naming themes and sub-themes*

There were 25 references extracted from the transcripts, that were coded into nine subthemes and three themes.

Findings and interpretation

Quantitative Findings

Pre- and post-tests were undertaken by both student groups. T-tests were used to identify significant differences among variables for the sample groups. The research question and its corresponding hypothesis were addressed using statistical analysis. The mean score was used as the numeric representation of participants. Preliminary assumption tests indicated the scores for students in post-tests of student-centred and traditional teaching pedagogy used in the hypothermia and hyperthermia classes ($\bar{x}$ = 45.85, SD = 10.55) and ($\bar{x}$ = 49.71, SD = 11.21) respectively. Table 3 shows the result of the t-test and paired sample tests for the student-centred teaching method. Table 4 shows the result of t-test and paired sample test for the traditional teaching method. Table 5 shows the overall summary of pre-test and post-test and paired sample t-test of both groups together as one whole group (n=24). Finally, comparison of

pair sample t-tests of both teaching methods is presented in Table 6.

Table 3. Student-centred teaching method: x̄ (SD) and paired samples t-test

Group	Variable	Pre-test		Post-test		Paired samples *t*-test		
		n	x̄ (SD)	*n*	x̄ (SD)	*t*	*df*	*p*
Student-centred teaching	**Age**	10	28(3.83)	10	28(3.83)	22.23	9	0.00
	Gender	10	1(0.00)	10	1(0.00)	22.23	9	0.00
	Hypothermia & Hyperthermia	10	34.40 (11.10)	10	45.85 (10.55)	-4.84	9	0.001
	Lifeboat	10	11.50 (2.51)	10	13.85 (1.75)	-4.86	9	0.001

Table 4. Traditional teaching method: x̄ (SD) and paired samples t-test

Group	Variable	Pre-test		Post-test		Paired samples *t*-test		
		n	x̄ (SD)	*n*	x̄ (SD)	*t*	*df*	*p*
Traditional teaching	**Age**	14	36.64(8.66)	14	36.64 (8.66)	15.52	13	0.00
	Gender	14	0.79(0.42)	14	0.79 (0.42)	15.52	13	0.00
	Hypothermia& Hyperthermia	14	28.82 (9.98)	14	49.71 (11.21)	-7.02	13	0.00
	Lifeboat	14	10.14 (3.12)	14	11.86 (1.29)	-2.10	13	0.06

Table 5: Overall summary of both teaching methods: x̄ (SD) and paired sample t-tests

Both Groups	Variable	Pre-test		Post-test		Paired samples *t*-test		
		n	x̄ (SD)	*n*	x̄ (SD)	*t*	*df*	*p*
Student-centred & Traditional teaching	**Age**	24	33.04 (8.19)	24	33.04 (8.19)	19.13	23	0.00
	Gender	24	0.88 (0.34)	24	0.88(0.34)	19.13	23	0.00
	Hypothermia& Hyperthermia	24	31.15(10.60)	24	48.10 (10.88)	-7.76	23	0.00
	Lifeboat	24	10.71(2.90)	24	12.69(1.77)	-3.87	23	0.001

Table 5 shows the collective result of pre- and post-tests. Students performed well in hypothermia and hyperthermia post-tests as compared to lifeboat post-tests which is also significant from "p" and "t" values.

Table 6. Comparing student-centred and traditional teaching: x̄ (SD) and paired sample t-tests

Group	Learning activity	Pre-test		Post-test		Paired samples *t*-test			
		n	x̄ (SD)	*n*	x̄ (SD)	*t*	*df*	*p*	x̄ dif.
Student-centred teaching	Hypothermia & Hyperthermia	10	34.40 (11.10)	10	45.85 (10.55)	-4.84	9	*P*<0.01	*11.45*
Traditional teaching	Hypothermia & Hyperthermia	14	28.82 (9.98)	14	49.71 (11.21)	-7.02	13	*P*<0.001	*20.89*
Student-centred teaching	Lifeboat	10	11.50 (2.51)	10	13.85 (1.75)	-4.86	9	*P*<0.01	*2.35*
Traditional teaching	Lifeboat	14	10.14 (3.12)	14	11.86 (1.29)	-2.10	13	*P*=0.06	*1.72*

Table 6 shows the comparisons between the student-centred and traditional teaching methods in hypothermia and hyperthermia. The t-test was statistically significant for hypothermia and hyperthermia (t = -4.84, p <0.01; t = -7.02, p <0.001). There is a narrow difference in p value. But this value shows that performance of traditional teaching method is better than student-centred teaching method in hypothermia and hyperthermia post-test. Also, "t" is greater in traditional teaching pedagogy. So, these statistical results support the traditional teaching method for the hypothermia and hyperthermia lectures.

By comparing value of "p" for the lifeboat classes (t = -4.86, p < 0.01; t = -2.104, p =0.06), the performance of a student-centred teaching method was found to be better than the traditional teaching method. "T" value is also greater. In the means sample for the lifeboat post-test, the student-centred teaching method shows a slightly higher mean (x̄ = 13.85, SD = 1.75) than the traditional teaching method (x̄= 11.86, SD= 1.29), supporting the benefit of a student-centered teaching method in lifeboat lectures.

Cohen's d was used to find effect size as compared to others, indicating the standard difference between two means (Social Science Statistics, n.d.). Mean values, standard deviations and sample numbers are used to find effect sizes in both teaching pedagogies for hypothermia, hyperthermia and lifeboat curricula. The student-centred teaching method had a large effect size (d = 1.06) and the traditional teaching method also had a large effect size (d = 1.97) in hypothermia and hyperthermia classes. However, in the lifeboat curriculum, the student-centred teaching method had a large effect size (d = 1.09) and the traditional teaching method had a medium effect size (d = 0.72).

Summary

The traditional teaching method demonstrated a larger effect size (1.97) for the hypothermia and hyperthermia curriculum compared to the student-centred teaching method (1.06). The students who studied under the traditional teaching method were going to sea for the first time, whereas students using the student-centred teaching method had prior ship-based working experience. Also, the t-test shows that the students exposed to the traditional teaching method did well in the exams on hypothermia and hyperthermia. But in the lifeboat t- tests, the student-centred teaching method did show good results and demonstrated a large size effect (1.09) compared to the students exposed to the traditional teaching method (0.72). Means in the pre-tests of the lifeboat, hypothermia and hyperthermia result shows that the students under the student-centred teaching method did well (Table 6). This may be because these students knew more about their profession compared to the students exposed to the traditional teaching method, who were going to sea for the first time. Finally, the statistical results for the hypothermia and hyperthermia lectures show support for traditional teaching, while the lifeboat lecture results support the student-centred teaching method.

Qualitative Findings

Three unique broad themes were identified from the thematic analysis: authentic learning, constructivist learning and self-directed learning. Nine subthemes were identified: Deep learning, Multiple perspectives, Multimodal learning, Real-world application, Knowledge sharing behavior, Intrinsic motivation, Student awareness, Flexibility and Scaffolded learning activities (see Table 7).

Table 7. Themes, sub-themes and their definitions

Theme	Subtheme	Definition
Authentic learning	Deep learning	According to Biggs and Tang (2011), deep learning is a feeling which comes from engaging the task in a proper and meaningful way. It involves mental processes and finding the reason to find solution.
	Multiple perspectives	It is acquiring the ability to see problem in miscellaneous ways. In result, it will boost ability to generate multiple possible solutions (Wang, Rose & Chang, 2010)
	Multimodal learning	It gives to students more options in understanding when information is presented in different forms like visual. aural and written. It improves performance of students. (Chen & Fu, 2003; Moreno & Mayer, 2007; Zywno, 2003).
Constructivist learning	Real-world application	Conceiving knowledge of events, objects and view of external world, interoperate in mind and comprise knowledge according to real world experience and beliefs (Jonassen, 1991).
	Knowledge sharing behavior	Knowledge sharing behaviors by individuals in a group of people are evident when, in group discussion, knowledge is processed and refined till it becomes common knowledge in the group (Yang 2004).
Self-directed Learning	Intrinsic motivation	Motivation which is self-determined and creates sound interest by engaging in the activity (Ryan & Deci 2000 a, b).
	Student awareness	It is the understanding of connection between the subject studying and its practical relation in real life (Johnson, 2000).
	Flexibility	Flexibility can be built into the following learning dimensions: time, place, pace, learning style, content, assessment, or learning path (Chen, 2003).
	Scaffolded learning activities	Scaffolding is achieved through structured learning activities that support and guide learning while simultaneously configuring and disciplining learning (Orlikowski, 2006).

Authentic Learning

Deep learning

Students in the sample identified that the student-centered teaching method engages them through different activities such as answering quizzes on the topic and finding their answers through reading the learning guide and searching the Internet themselves. They referred to taking "the information in your own views" (Pat) and that this will "make [information] more longer lasting [in my mind]" (Sam). In traditional teaching, if only providing a PowerPoint presentation, the students write some notes using the same information as already provided in PowerPoint. Students thought that the student-centred teaching method would mean retaining "knowledge will be more" (Gerald). Because students use different modes of learning which include listening to lectures, looking at PowerPoint, using the learning guide and Internet, the information is "deeply" embedded in "our mind" (Doug).

Multiple perspectives

Students in the interview sample identified that access to multiple opportunities to learn meant they were better able to engage with the content and success. Access to multiple sources motivate the students to engage with the content and want to learn "even if the lecturer is not in the class … [because] … students can get [the] answer early from the books and [the] internet" (Sam). Students perceived that more personal effort is required when learning from student-centred teaching, because using "source of information yourself requires you to put more mental efforts" (Gerald).

Multimodal learning

Students in the sample noted there were more pictures in the PowerPoint presentation prepared for the student-centred teaching approach. However, they noted that some pictures were without explanatory text, and their graphics were not clear. For clear understanding and interpretation, students commented that "graphic approach should be clear like an actual person of a picture" (Doug) and that, for pictures, "critical information should be there" (Sam) to enable better understanding.

Constructivist learning

Real-world application

Students in the sample identified that critical thinking is more useful when students enter the practical life of their profession. Critical thinking skills mean students can "figure out on your own and why are they doing [a job] this way" (Pat). Constructivist learning facilitates students' learning to "think out of box and can give our own opinions? How is happening? What is the reason and what is theory behind [it]?" (Doug). Learning happens when students try to find out answers for themselves from multiple resources. "It leads to the new question [and] helps [students] to think new thinking" (Sam), and students "will remember [their] subject for a long time" (Gerald).

Knowledge sharing behaviors

Students in the sample identified that, in traditional teaching, there was no discussion and students hesitated to ask questions. While in a student-centred pedagogy, "it was good to discuss answers [and] come to alternative views that you may not [have] thought off" (Pat). Because "through discussion, you compare notes in order to double check and confirm what you have written and what you have missed" (Gerald). In traditional teaching, "some students are shy and do not like to ask questions" (Sam).

Self-directed Learning

Intrinsic motivation

Students in the sample found the activities in the student-centred teaching pedagogy "interesting and quite useful" (Sam). By searching for the answer to a question themselves, "critical thinking would improve, [also] retention [of] information [and] interest would improve" (Gerald). Because students are required to use multiple resources to find answers and are not limited to one source, "It is not like, you are framed in a box, it is good approach of learning" (Doug).

Student awareness

Students in the sample identified that in traditional teaching lectures, they did not have "full understanding of the reason behind the topic, [and] not actually sure why the lecturer do it that way" (Pat). Just listening to the lecture and looking

at the PowerPoint presentation means students "might just read it [PowerPoint] and memorise it" (Doug). So, students were aware they are less likely to remember the topic delivered by traditional teaching and "ultimately after one day, two days, three days or one week, you will forget it" (Sam).

Flexibility

Students in the sample identified that there is no activity involved in the traditional teaching as compared to student-centred teaching. Student-centred teaching requires "more time for [working on the] answer of questions given in classroom activity. Because people format their own answer" (Gerald). However, it was felt students should be given "a bit more time" (Doug) to complete the activities in student centric teaching.

Scaffolding learning activities

Students in the sample identified that building knowledge on the topic helps students to complete activity of finding answers through using multiple resources. Especially if students are learning a new subject and have "got some basic knowledge [they] can build critical thinking on it" (Pat). Initial knowledge is important for any subject "before starting research for the answer" (Gerald).

Summary

Figure 1 represents the three themes and nine subthemes.

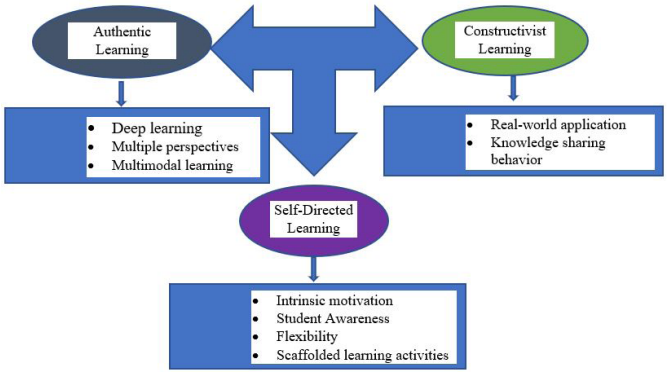

Figure 1: Three themes and nine subthemes

These three themes were developed using inductive thematic analysis from the transcription and analysis of all interviews. These themes relate to the research aim which supports a student-centred teaching method.

Discussion

Three curricula were presented to students: hypothermia, hyperthermia and lifeboat. They were presented in the student-centric approach in group 1 and traditional mode of teaching in group 2, all with student outcomes measured via pre-and post-test survey. The qualitative analysis supported the student-centric teaching approach, in line with the research aims. The quantitative data did not demonstrate a significant difference in the support of the student-centred teaching method in the hypothermia and hyperthermia lecture, but it did suggest a trend to improved learning in the lifeboat lecture.

The qualitative research has resulted in three themes that can be used as a lens to inform curriculum design that develops critical thinking and self-directed learning in students. When students try to find out answers for themselves from multiple resources then "it leads to the new question [and] helps [students] to think new thinking" (Sam). Also, critical thinking and self-directed learning happen when students can "figure out on your own and why are they doing [a job] this way" (Pat). Main themes which were identified are "authentic learning", "constructivist learning" and "self-directed learning" These outcomes support the research from different authors in teaching methods that promote critical thinking. According to Prideaux et al. (2013) and Wolf and Archer (2013), the purpose of reducing face-to-face time is that students can do more interactive learning. But lecturer's emphasis on traditional teaching only means no discussion in the class, no-problem solving and no thinking skills. It will affect the quality of learning and teaching.

The quantitative analysis indicated that, for hypothermia and hyperthermia lectures, the student-centric teaching method was not as successful for learning, but it was for the lifeboat curriculum. This may be because students in group 2 had basic knowledge and had not yet been at sea. While they could understand information about hypothermia and hyperthermia delivered by lecture, the lifeboat lecture when done in the traditional way did not produce as good outcomes as the student-centred approach. Student-centred teaching enabled higher growth in the lifeboat exercise but didn't have as large an impact for the hypothermia and hyperthermia lecture. The latter is possibly due to the different cohorts of students, with those exposed to the student-centred method having a higher baseline performance and potential apathy to the learning. The latter started with a far lower baseline and had a greater interest in learning. Retesting this data is critical to assess the value of the student-centred method in equivalent contexts. Additionally, the effect of student-centric learning approaches may be limited because students are doing short courses. Active learning takes more time, this may not work when students have a short time to learn specific information. Other reasons may be that inadequate feedback may have been given by the lecturer after group discussion in the activity. Is it important how the feedback is given? The lecturer should show and discuss answers for the class activity questions, referring to the learning guide and projector. Another reason may be that only one to two websites were provided to search for the answers. More websites would improve student ability to critically reflect on data contained therein and to synthesise this. If we implement these three themes from a qualitative analysis in our teaching, students will learn critical thinking and will learn to research by themselves. This result adds value to our current teaching system.

Conclusions

This research aimed to explore teaching pedagogy which can build critical thinking in students. So, seafarers can find answers themselves by going through different resources like using technology, through library books and then by discussion. In qualitative data analysis, three themes were developed which supported the student-centred teaching method. These themes are authentic learning, constructivist learning and self-directed learning. While the quantitative data demonstrated a difference in one of the two lectures. So, in one lecture quantitative analysis did not support the student-centric teaching approach.

While the research reported demonstrates promise, there were some limitations to this exploratory study. The first is a time issue in applying the student-centred teaching method, especially when covering all three themes. Lecturers need to design the courses for fostering critical thinking in their students, and in a short course, there are limited opportunities to alter the course structure in a controlled way to conduct pre- and post-tests.

Another limitation may be that the first group perhaps did not take the testing seriously. The second group may have taken it more seriously as they were going into the shipping industry for the first time. Further research should ensure that students across both sample groups have the equivalence of experience. This was a small study, with a small sample size, and the quantitative method did not support the aim in one lecture out of two. Further research is needed to understand if the student-centred teaching method can be successfully incorporated in AMC short courses, diploma and degree programs.

References

Anderson, W. L., Mitchell, S. M., & Osgood, M. P. (2006). Comparison of student performance in co-operative learning and traditional lecture-based biochemistry classes. *Biochemistry and Molecular Biology, 33*(6), 387-393.

Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research and Method in Education, 5*(6), 66-70.

Bean, J. C. (2011). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom*. United States: Jossey-Bass.

Biggs, J., & Tang, C. (2011). *Teaching for quality learning at university* (4th ed.). Berkshire UK: Open University Press.

Bligh, D. (1998). *What's the use of lectures?* Eastbourne, Great Britain: Anthony Rowe Publication.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101.

Bryman, A., & Burgess, B. (Eds.). (2002). *Analyzing qualitative data*. London and New York: Abingdon.

Camic, P. M., Tischler, V., Pearman, C. H. (2014). Viewing and making art together: A multi-session art-gallery-based intervention for people with dementia and their carers. *Aging and Mental Health, 18*(2), 161-168.

Carr, A. R., Kelder, J-A., & Crawford, J. (2020). Exploring the impact of SoTL on day-to-day learning and teaching: A conceptual framework for professional development and quality improvement. In R. Plews & M. Amos (eds.), *Evidence-based faculty development through the scholarship of teaching and learning (SoTL)* (pp. 388-412). Hershey, Pennsylvania: IGI Global.

Chen, G., & Fu, X. (2003). Effects of multimodal information on learning performance and judgment of learning. *Journal of Educational Computing Research, 29*(3), 349-362.

Chen, D.-T. (2003). Uncovering the provisos behind flexible learning. *Educational Technology & Society, 6*(2), 25-30.

Collins, J. (2009). Lifelong learning in the 21st Century and beyond. *RadioGraphics, 29*(2), 613-622.

Cossette, G. (2013). *Action research: The development of critical thinking skills*. ED580: Action Research Seminar

Crawford, J., & Butler-Henderson, K. (2020). Digitally empowered workers and authentic leaders: The capabilities required for digital services. In K. Sandhu (Eds.), *Leadership, management, and adoption techniques for digital services*. Hershey, Pennsylvania: IGI Global.

Crawford, J. A., Dawkins, S., Martin, A., & Lewis, G. (2020). Putting the leader back into authentic leadership: Reconceptualizing and rethinking leaders. *Australian Journal of Management, 45*(1), 114-133.

Crawford, J., & Kelder, J-A. (2019). Do we measure leadership effectively? Articulating and evaluating scale development psychometrics for best practice. *The Leadership Quarterly, 30*(1), 133-144.

Dayna, L. (2013). *Authentic learning experiences: A real-world approach to project-based learning*. New York: Routledge.

Fedila, M. (2007). *Appropriateness of problem-based learning in maritime education and training*. World Maritime University Dissertations. 40. Available: http://commons.wmu.se/all_dissertations/40

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Dispositions, skills, structure training, and metacognitive monitoring. *American Psychologist, 53*(4), 449-455.

Hawkins, C., Crawford, J., Carr, A., Kelder, J., & Knox, M. (2019). Evaluating leadership, wellbeing, and belonging in students over teaching periods, *Teaching Matters 2019: Our distinctive future*, 26 November 2019. Hobart, Tasmania: University of Tasmania.

Herrington, B. J. (2006). *Authentic learning environments in higher education*. USA &UK: Information Science Publication.

Johnson, L. S. (2000), The relevance of school to career: A study in student awareness. *Journal of Career Development, 26*(4), 263-276.

Jonassen, D.H. (1991). Evaluating constructivistic learning. *Educational Technology, 31*(9), 28-33.

Knight, J. K., & Wood, W. B. (2017). Teaching more by lecturing less. *Cell Biology Education, 4*(4), 261-343.

Kopzhassarova, U., Akbayeva, G., Eskazinova, Z., Belgibayeva, G., & Tazhikeyeva, A. (2016). Enhancement of students' independent learning through their critical thinking skills development. *International Journal of Environmental & Science Education, 11*(18), 11585-11592.

Liu, C. C., & Chen, I. J. (2010). Evaluation of constructivism. *Contemporary Issue in Education Research, 3*(4), 63-66.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook and the coding manual for qualitative researchers.* London: Sage Publications.

Moreno, R., & Mayer, R. (2007). Interactive multimodal learning environments. *Educational Psychological Review, 19*, 309-326.

Neo, M. (2003). Developing a collaborative learning environment using a web-based design. *Journal of Computer Assisted Learning, 19*(4), 462-473.

Orlikowski, W. J. (2006). Material knowing: The scaffolding of human knowledgeability. *European Journal of Information Systems, 15*(5), 460–466.

Oblinger, D. G. (Ed.). (2007). Authentic learning for the 21st century: An overview. *Educause: Learning Initiative, Paper, 5*.

Prideaux, D., Lindemann, I., & Cottrell, A. (2013). Community and workplace expectations of graduates in the health professions. *Educating Health Professionals: Becoming a University Teacher,* 71-82.

Rissanen, A. (2018). Student engagement in large classroom: The effect on grades, attendance and student experiences in an undergraduate biology course. *Interceram, 18*(2), 136-153.

Ryan, R. M., & Deci, E.L. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*, 54–67.

Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and facilitation of intrinsic motivation, social development and well-being. *American Psychologist, 55*(1), 68-78.

Saltman, D. (2012). Student-directed learning comes of age. *Educational Digest: Essential Readings,* 4-8.

Social Science Statistics. (n.d.). *Effect size of calculator for t-test.* https://www.socscistatistics.com/effectsize/default3.aspx

Tiwari, A., Lai, P., So, M., & Yuen, K. (2006). A comparison of the effects of problem-based learning and lecturing on the development of students' critical thinking. *Medical Education, 40*(6), 547-554.

Vazquez, J. J., & Chiang, E. P. (2014). A picture is worth a thousand words (at least): The effective use of visuals in the economics classroom. *International Review of Economics Education, 17,* 109-119.

Wang, H. C., Rose, C. P., & Chang, C. Y. (2011). Agent-based dynamic support for learning from collaborative brainstorming in scientific inquiry. *International Journal of Computer-Supported Collaborative Learning, 6*(3), 371-395.

Webb, N. M. (2010). The teacher's role in promoting collaborative dialogue in the classroom. *British Journal of Educational Psychology, 79*(1), 1-28.

Wieman, E. (2007). Why not try a scientific approach to science education. *The Magazine of Higher Learning, 39*(5), 9-15.

Wilson, B. G. (1996). *Constructivist learning environments: Case studies in instructional design.* Eaglewood Cliffs, New Jersey: Educational Technology Publication.

Wolf, K., & Archer, C. (2013). Managing ambiguity: A critical reflection on a truly global learning experience. *Proceedings of the 22nd Annual Teaching Learning Forum*, 7-8 February 2013. Perth: Murdoch University.

Yang, J. T. (2004). Job-related knowledge sharing: Comparative case studies. *Journal of Knowledge Management, 8*(3), 118-126.

Zywno, M. S. (2003). A contribution to validation of score meaning for Felder-Solomon‟s Index of Learning styles. *Proceedings of American Society for Engineering Education Conference and Exposition.*